

# DISTRIBUTION AND BIOLOGY OF TWO SYMPATRIC *PHALERIA* SPECIES (COLEOPTERA: TENEBRIONIDAE) ON MALTESE SANDY BEACHES

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## Abstract

Differences in the zonation and habitat preferences of two sympatric *Phaleria* species on five Maltese sandy beaches were investigated. *P. bimaculata* has a more seaward zonation than *P. acuminata* and occurs at higher densities. Behavioural aspects of the two species were also investigated in the laboratory through the use of choice chambers. The two species have similar sand moisture content and grain-size preferences, and a similar phenology, but different sand organic content preferences

**Keywords:** *Beach, Behaviour*

## Introduction

Beetles of the genus *Phaleria* are one of the major consumers of debris on sandy beaches in the Mediterranean. The coexistence of different species of *Phaleria* on Mediterranean islands has been well documented [1, 2]. One such species-pair – *Phaleria acuminata* and *Phaleria bimaculata* – occurs in the Maltese Islands [3], with the two species being sympatric on some beaches and allopatric on others. Zonation along the shore, sand moisture content, sand organic content and sediment grain-size preferences, as well as seasonal variation in abundance, were investigated for the two species.

## Materials and Methods

Five Maltese sandy beaches (Mgġiebah, Golden Bay, and White Tower Bay on Malta, and Ramla l-Hamra and Xatt l-Ahmar on Gozo) were sampled during different seasons in 2001-2003 and in 2006-2007 by means of pitfall traps placed at regular intervals between the strandline and the vegetated margins of the beach. At each station, two plastic cups were buried flush with the sand surface and connected by wooden walkways that acted to deflect animals into the traps; traps were left overnight. For behavioural experiments, individuals of both species were tested separately in a series of choice chambers (glass troughs) presenting, in separate trials, choices between sand with different (i) moisture content, (ii) organic content, and (iii) grain size. At the end of each trial the number of *Phaleria* individuals in each compartment of the choice chamber was recorded by sieving out the sand and counting the number of individuals.

## Results and Discussion

The *Phaleria* species occurred sympatrically on two beaches (Golden Bay, Mgġiebah) and allopatrically on the other three (*Phaleria acuminata* – Ramla l-Hamra; *Phaleria bimaculata* – Xatt l-Ahmar and White Tower Bay). On Mediterranean beaches with sympatric *Phaleria*, the two species normally occupy different zones (e.g. [2]). In the present study, sympatric *P. bimaculata* had a more seaward distribution than *P. acuminata*; peak densities of *P. bimaculata* and *P. acuminata* occurred at a mean distance of 9m and 41m away from mean sea-level (MSL), respectively. Additionally, *P. bimaculata* was consistently recorded in higher densities than *P. acuminata* on beaches where the two species were sympatric (mean capture frequency: *P. bimaculata* =  $3.35 \pm 5.33SD$  inds/trap/hr; *P. acuminata* =  $0.97 \pm 1.06SD$  inds/trap/hr). Whilst such interspecific differences in position on the shore have been attributed to differences in sand moisture preferences [3], no significant differences in sand moisture preferences for the two *Phaleria* species were found in the choice experiments made in the present study. Zonation of sympatric *Phaleria* species could be due to a preference for different sand grain sizes [4] but again, choice-chamber experiments made in the present study did not show significant differences between the grain-size preferences of the two species, while all the beaches sampled were characterized by 'medium sand' (Wentworth-Udden scale), except for the wet zone of White Tower Bay (medium/fine sand), where only *P. bimaculata* was recorded. A temporal variation in abundance of sympatric species-pairs of *Phaleria* has been suggested [3]; the results of the present study as well as of a previous one [5] do not support this since the sympatric *Phaleria* species showed similar seasonal patterns, with the highest abundances recorded in the spring and the lowest in autumn in both species. The present study did not identify any beach physical parameter that modulates the zonation and abundance of the two species, and in Malta at least, *P. acuminata* and *P. bimaculata* appear to have a high degree of niche overlap. However, in behavioural experiments, *P. bimaculata* exhibited a significantly ( $p=0.05$ ) higher preference for organically enriched sand than *P. acuminata*, hinting at possible niche partitioning in terms of feeding preferences. It has been suggested that *Phaleria* species make good bio-indicators of the health of

beach ecosystems [6], however, before they can be used as such, a good knowledge of their ecology and behaviour is necessary, especially when different species occur sympatrically. *P. bimaculata* was previously recorded from Ramla l-Hamra ([7], but was not found there in other studies (e.g. [5]), including the present one. This may either mean that the species has become extinct from this beach or else that the population here is so small and patchily distributed that it is not easily sampled; in either case, this underlines the precarious nature of populations of psammophilic species in localities such as the Maltese Islands where sandy beaches are few and small and under heavy anthropogenic pressure [8].

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